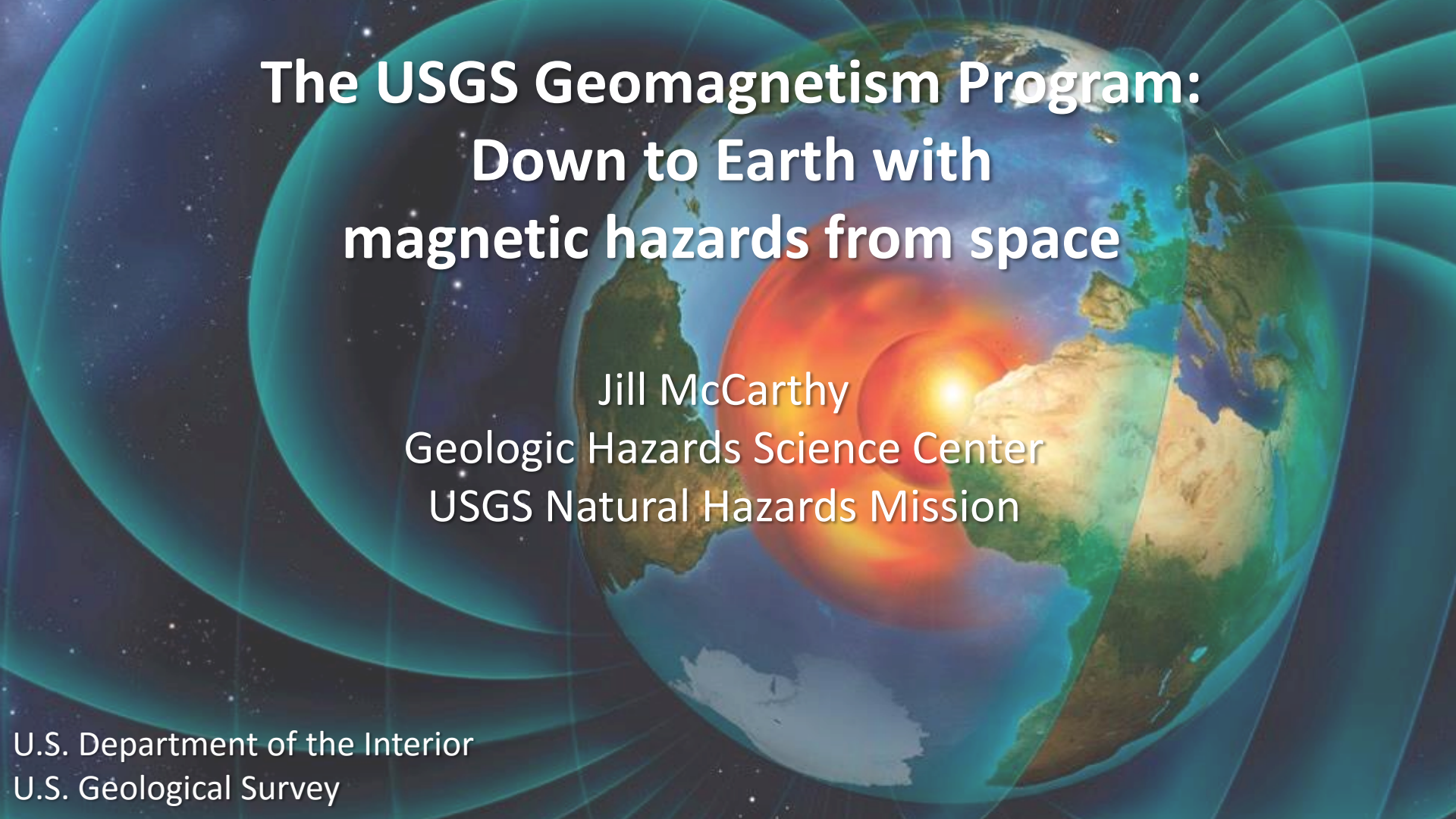


The USGS Geomagnetism Program: Down to Earth with magnetic hazards from space

Jill McCarthy
Geologic Hazards Science Center
USGS Natural Hazards Mission

U.S. Department of the Interior
U.S. Geological Survey

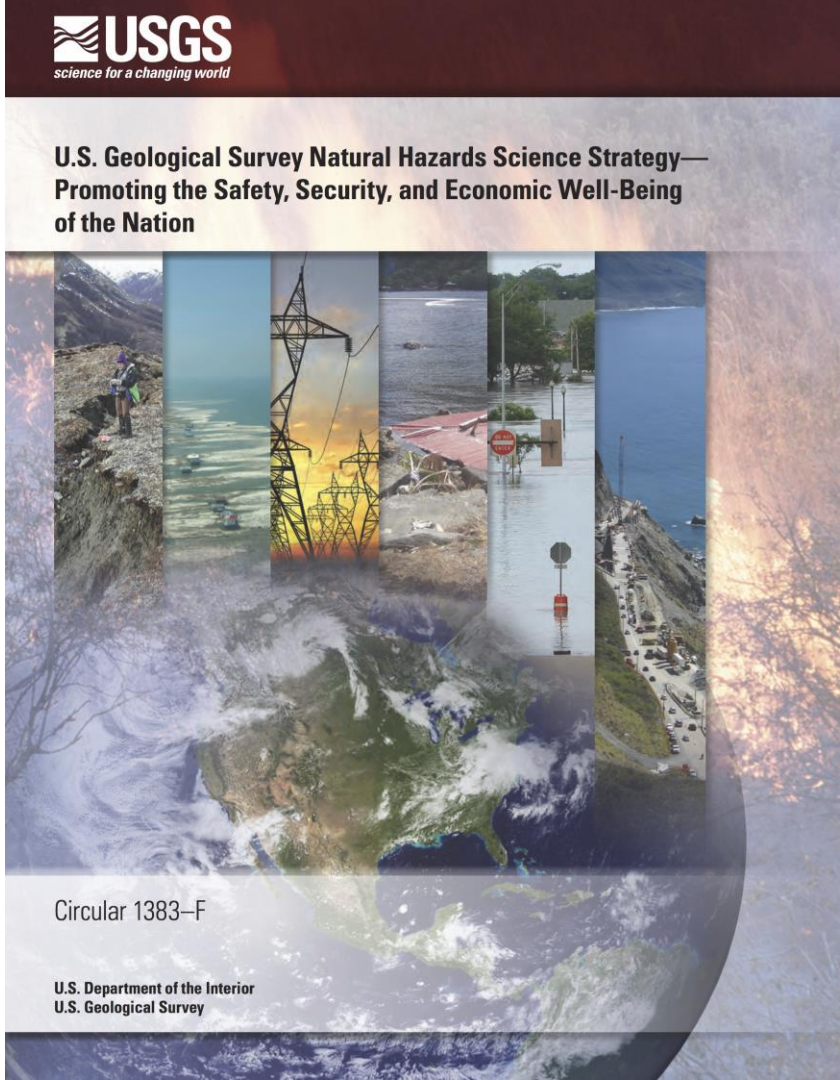
USGS Natural Hazards Mission

Six hazard science programs:

- Earthquake Hazards
- Global Seismographic Network
- Volcano Hazards
- Landslide Hazards
- Coastal & Marine Geology
- Geomagnetism

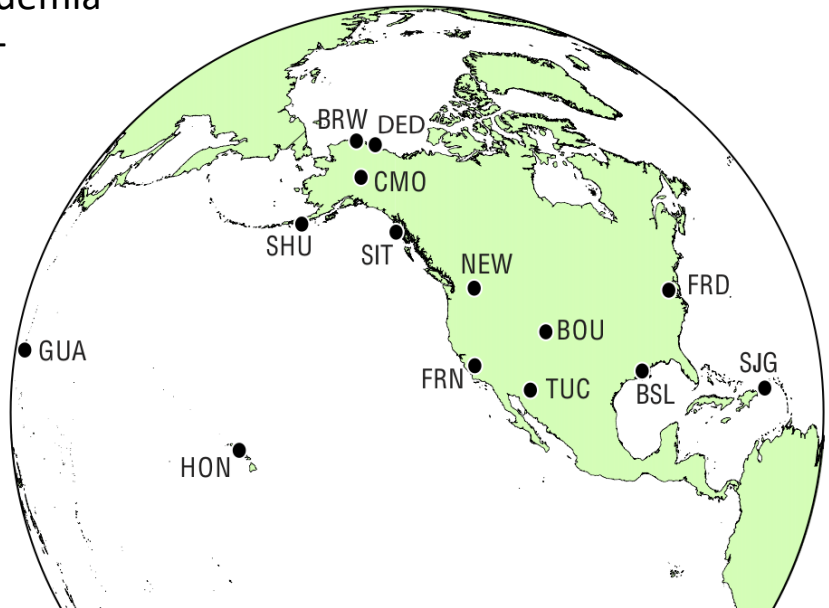
Strategic priorities for hazard science:

- Enhanced observations
- Fundamental understanding
- Assessment products and services
- Effective situational awareness



USGS Geomagnetism Program Summary
geomag.usgs.gov

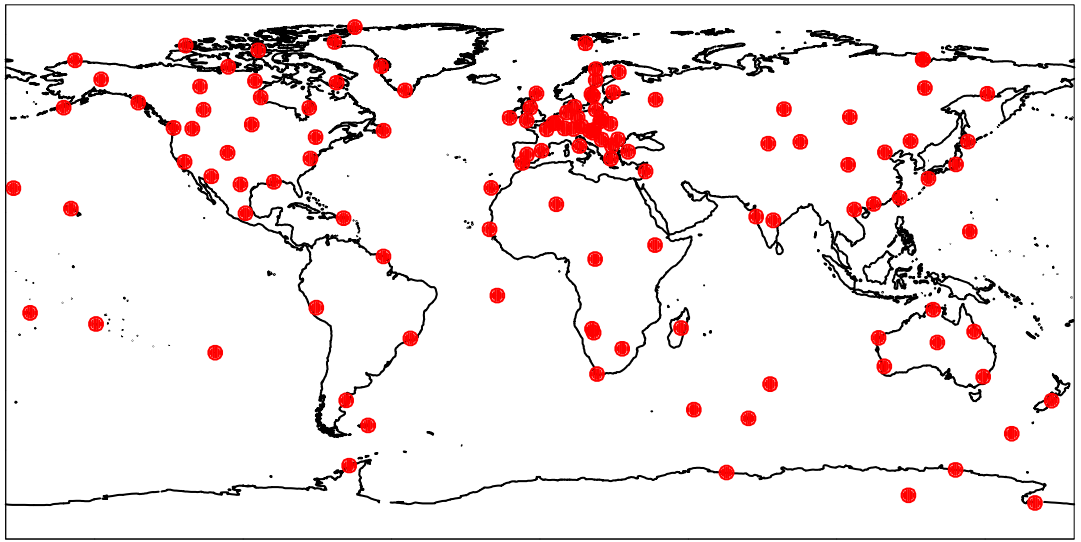
- Part of a USGS Natural Hazards Mission
- DOI representative for NSTC's SWORM project; Space Weather Strategy & Action Plans
- Monitor Earth's magnetic field at ground-based magnetic observatories.
- Report data with high accuracy, resolution, and reliability
- Customers: Air Force, NOAA, NASA, GFZ, industry, academia
- Promote operations around the world: INTERMAGNET
- Operational partnership with oil & gas industry
- Conduct research of societal importance
- Carol A. Finn, Geomagnetism Group Leader
- 16 staff, 14 observatories
- Budget: $1.9 million/yr



Love, J. J. & Finn, C. A., 2011. The USGS Geomagnetism Program and its role in space weather monitoring, Space Weather, 9, S07001, doi 10.1029/2011SW000684

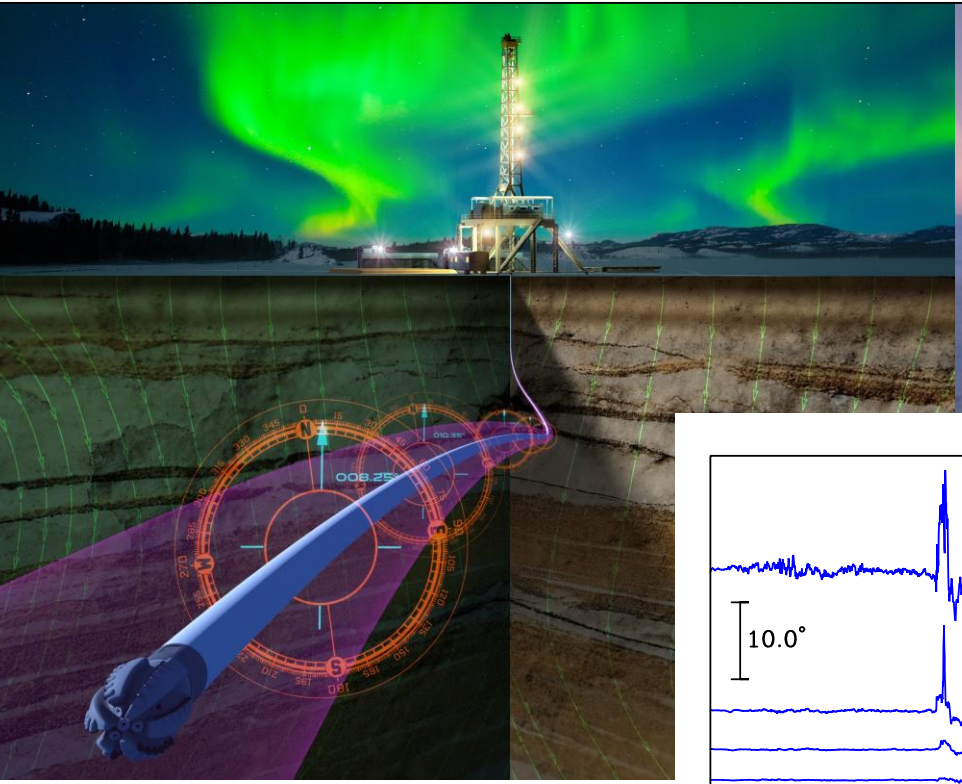
INTERMAGNET (www.intermagnet.org)

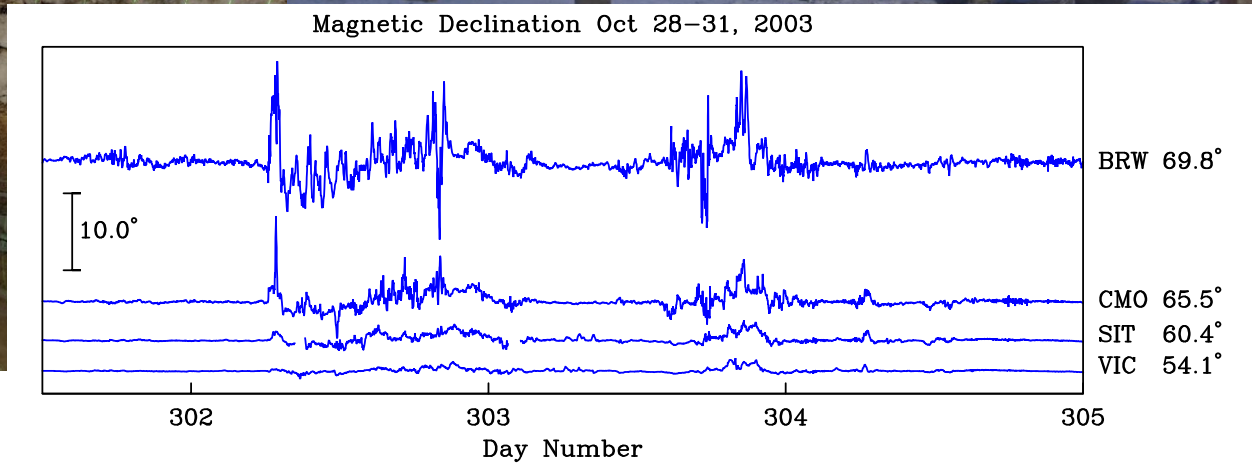
- Voluntary consortium: 120 observatories, 55 institutes, 42 countries
- Modern operational standards, checks data quality, organizes data, website
- Certified INTERMAGNET data since 1991 --- over two solar cycles!
- All observatories produce 1-minute data. Approx. 60 produce 1-second data.
- Many institutes are real-time
- Supports:
  - Space-weather monitoring
  - Induction-hazard assessment
  - Main-field mapping
  - Aeromagnetic surveys
  - Magnetic indices
  - Solid-Earth geophysics
  - Space physics



Love, J. J., Chulliat, A., 2013.
An international network of magnetic observatories, Eos, 94(42), 373-374, doi:10.1002/2013EO420001.

Magnetic orientation for directional drilling for oil & gas: A public-private collaboration





Schlumberger

USGS science for a changing world

Buchanan, A., Finn, C. A., Love, J. J., Worthington, E. W., Lawson, F., Maus, S., Okewunmi, S. & Poedjono, B., 2013. Geomagnetic referencing - The real-time compass for directional drillers, Oilfield Rev., 25(3), 32-47.

National Space-Weather Strategy and Action Plans
National Science and Technology Council
Office of Science and Technology Policy

Department of the Interior (DOI) and U.S. Geological Survey (USGS):

Goal 1: Geophysical Benchmarks

- Co-lead for benchmark development.
- Geoelectric benchmarks: 100-year event, theoretical upper-limit event.

Goal 5: Space-Weather Services

- Sustain and expand geomagnetic monitoring.
- Initiate geoelectric monitoring.
- Support magnetotelluric surveys: augment those of NSF EarthScope Program.
- Map geomagnetic and geoelectric hazards.
- Collaborate with other agencies on space-weather data calibration and accuracy.

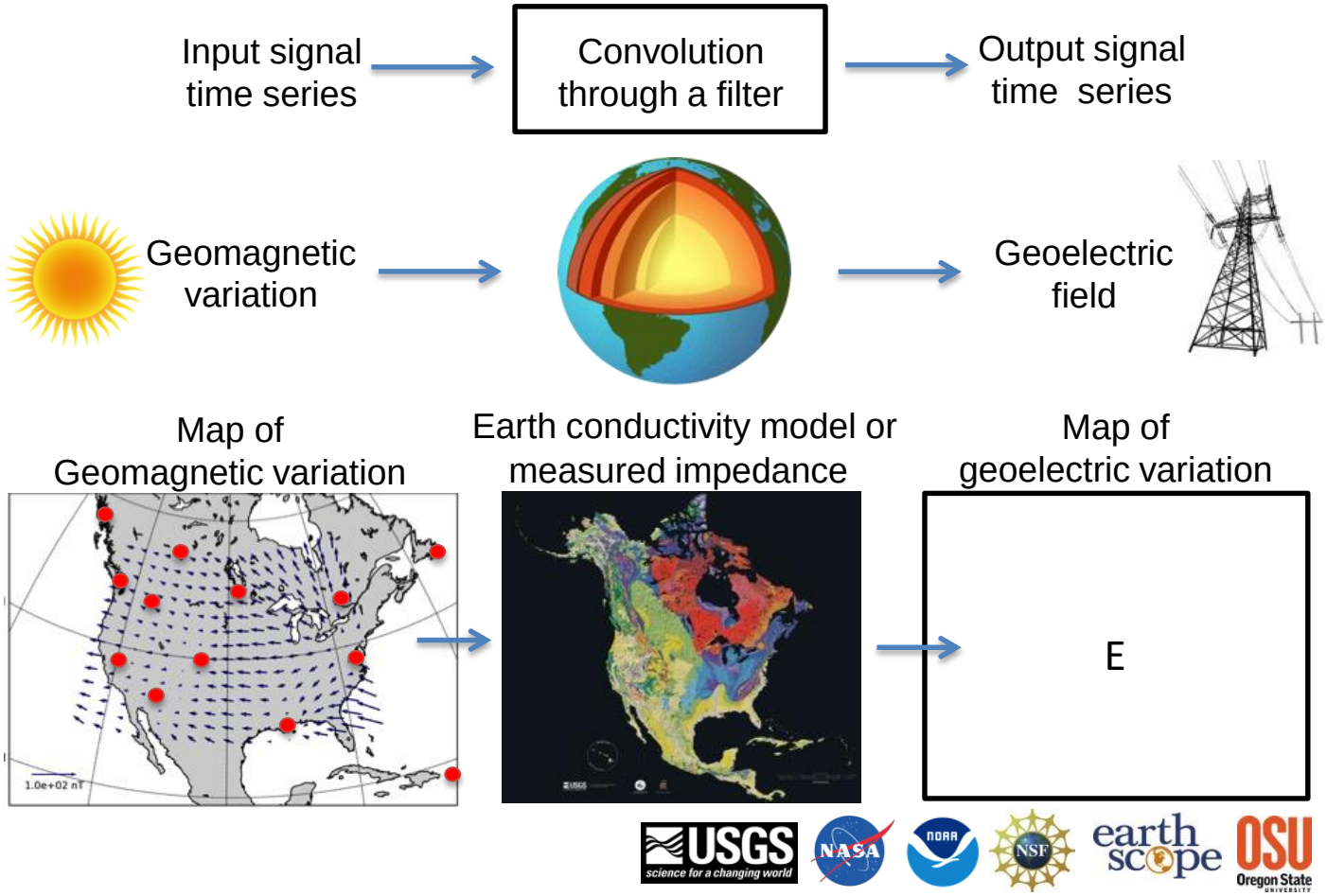
Goal 6: International Cooperation

- Improve global geomagnetic monitoring, improve global data exchange.

President's 2017 budget for USGS Geomagnetism Program: Increase of $1.7 million/year to $3.6 million/year

This additional funding would enable DOI responsibilities within OSTP's National Space Weather Action Plan:

- New geomagnetic observatories.
- Geoelectric monitoring at some observatories.
- Magnetotelluric surveys, augmenting those of the NSF EarthScope Program.
- 3D modeling of lithospheric electrical conductivity.
- Scenario assessments of induction hazards.
- Real-time geoelectric mapping capability.
- Support international geomagnetic monitoring and data exchange.
- Induction-hazard research of importance for National economy and security.
- Relieve US Air Force of financial support for USGS operations.



Love, J. J., Rigler, E. J., Pulkkinen, A., Balch, C. C.,
2014. Magnetic storms and induction hazards, Eos, Trans. AGU, 95(48), 445-446, doi10.1002/2014EO480001.

GEOLOGICAL SOCIETY OF AMERICA
DECADE OF NORTH AMERICAN GEOLOGY

GEOLOGIC MAP OF NORTH AMERICA

2005

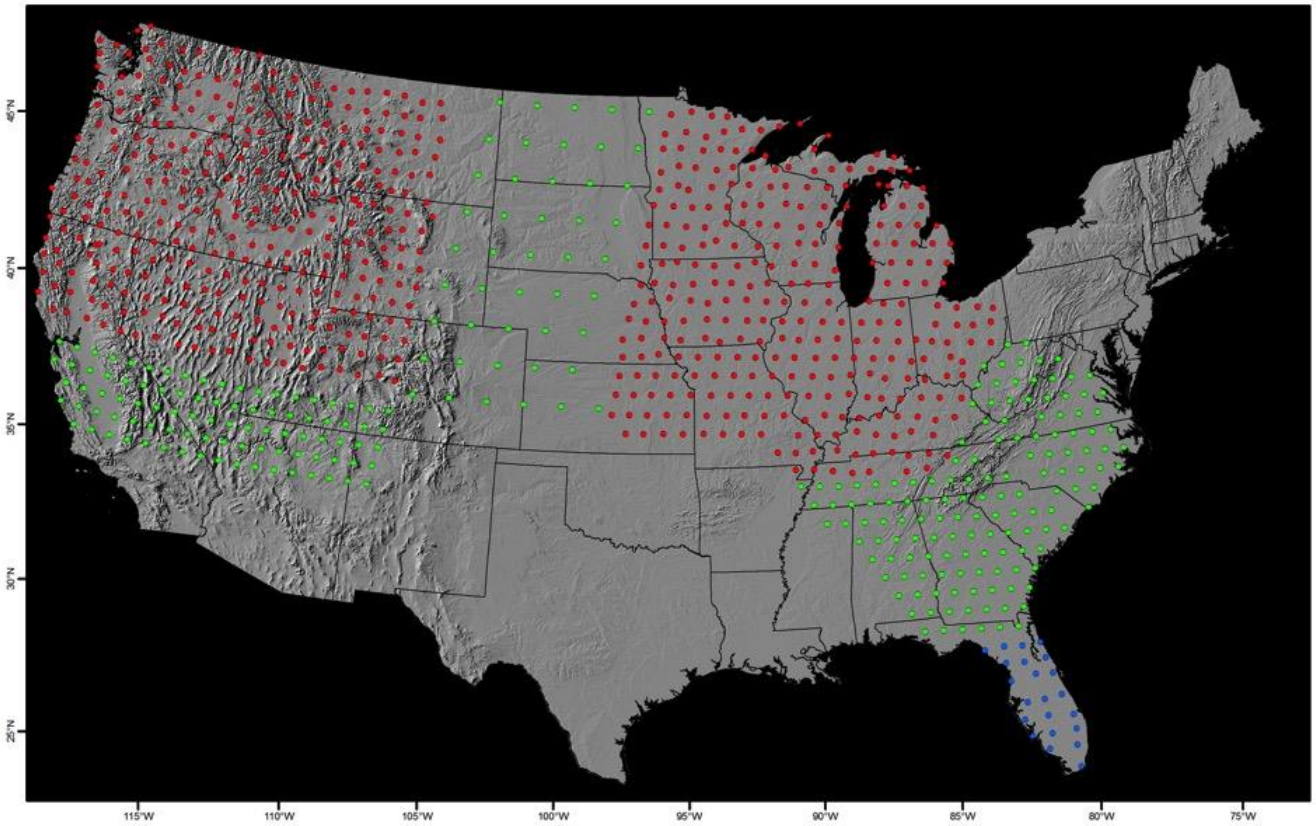
Compiled by John C. Reed, Jr., John O. Wheeler, and Brian E. Tucholke

Continental geology by John C. Reed, Jr. and John O. Wheeler
With assistance from K.D. Card, A. Davidson, P.F. Hoffman, A.V. Okulitch, A.R. Palmer, B.V. Sanford, G.K. Williams, and H.Williams
Seafloor geology by Brian E. Tucholke
With assistance from J. Dixon, A.F. Embry, T.L. Holcombe, E.P. Laine, G.S. Mountain, P. Popenoe, B.V. Sanford, and T. Wiley
Cartographic design and conventional cartography by James E. Queen
Color design by Jan Derrin

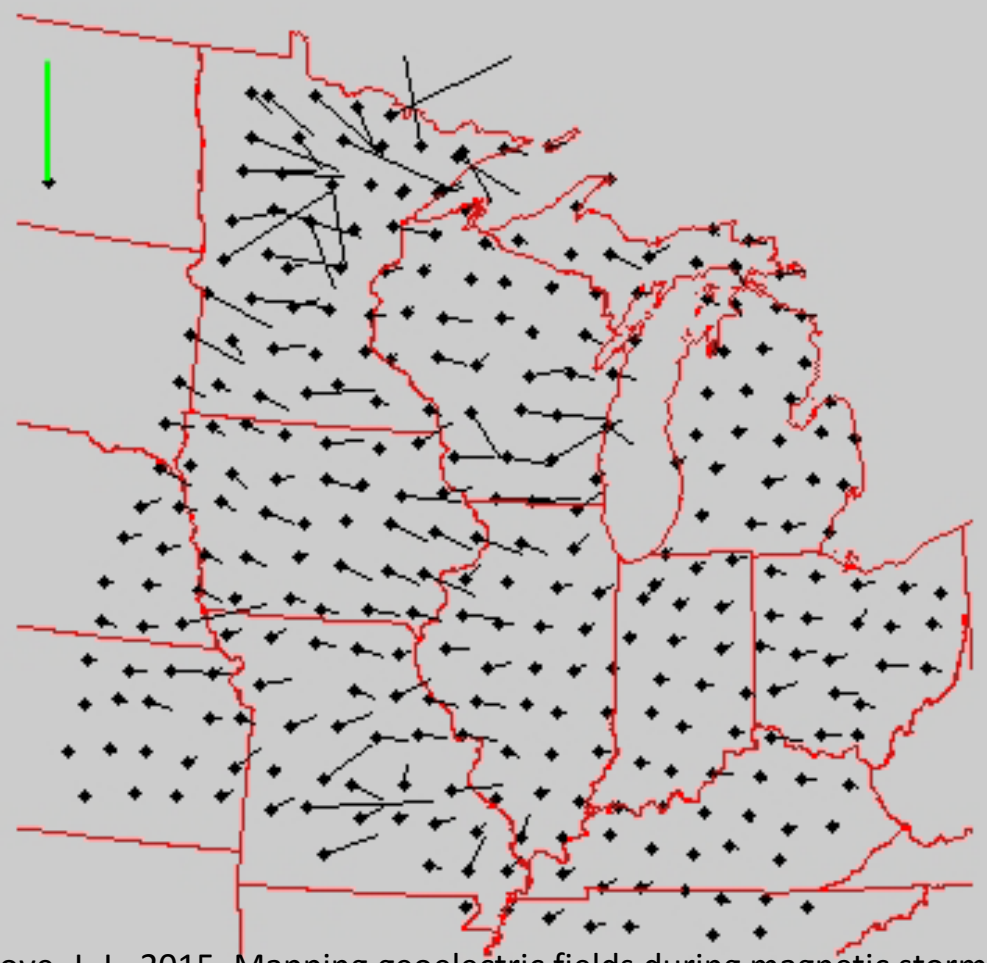
Digital editing and digital cartography by Will R. Stettner, Linda Masonic, Alex J. Donatich,

Base map by the U.S. Geological Survey. Modified spherical transverse Mercator projection
Central meridian 100°W, scale factor 0.926.

NSF EarthScope MT survey by 2018 with recent USGS work in Florida.

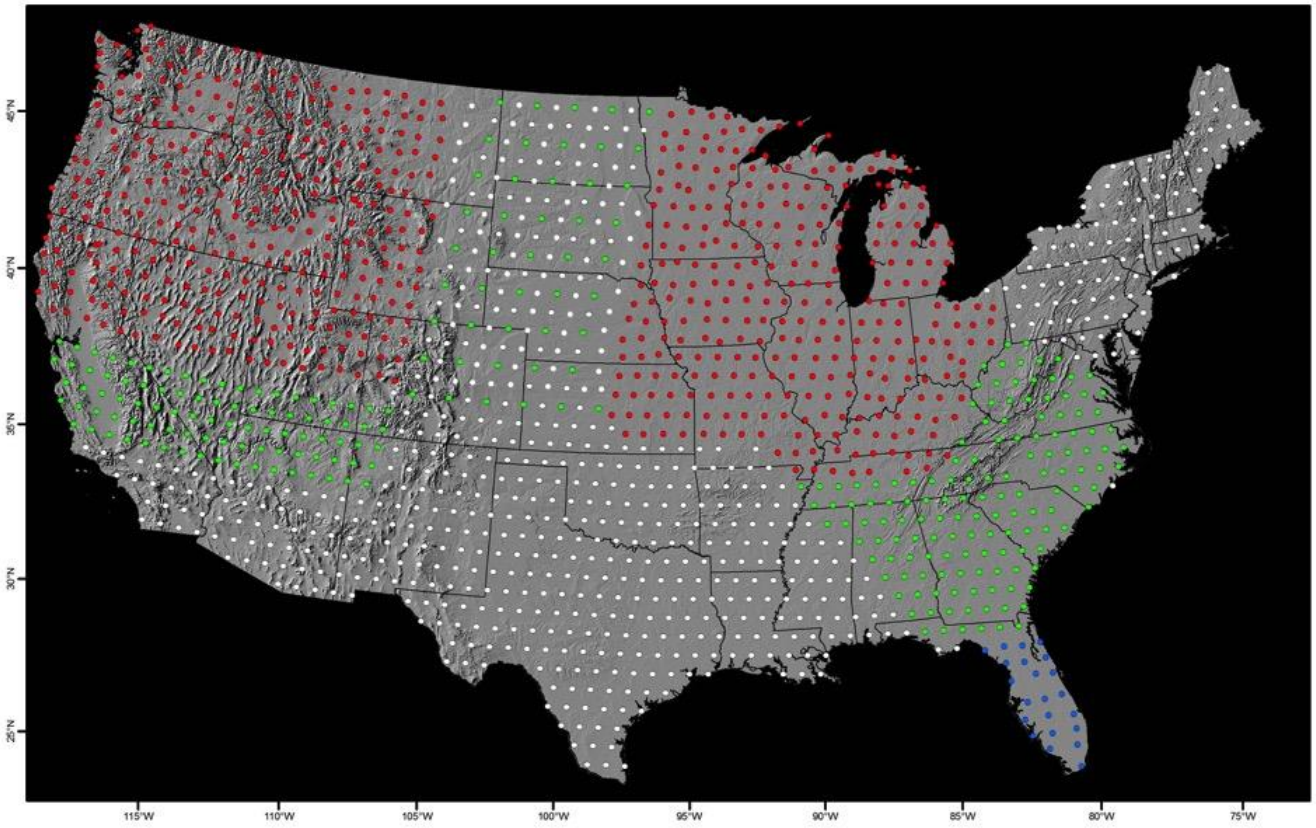


Surveys are accomplished through temporary “transportable” array deployments of ground-based geomagnetic and geoelectric sensors.



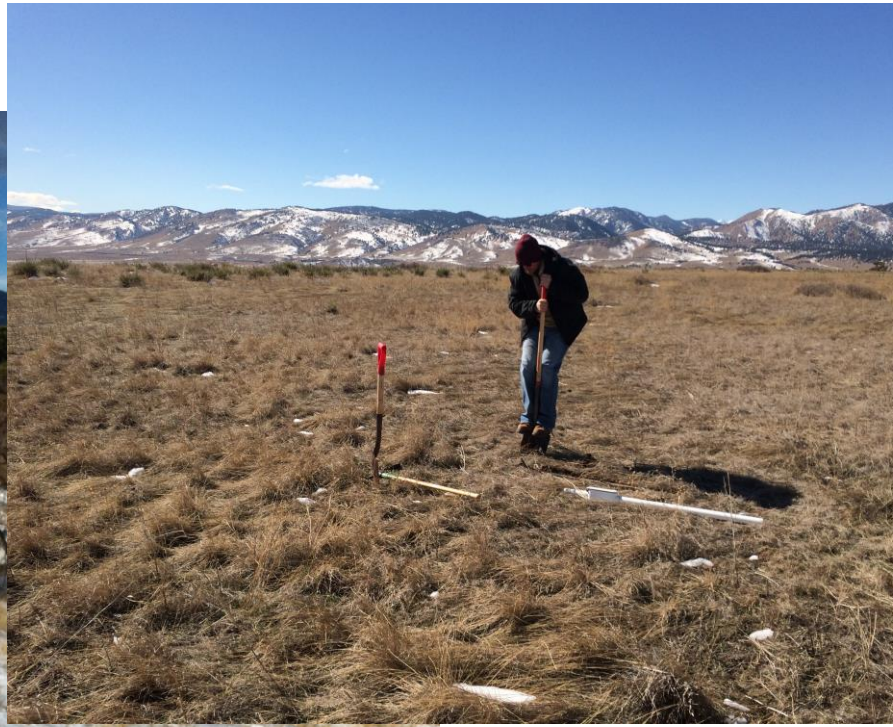
Bedrosian, P. A. & Love, J. J., 2015. Mapping geoelectric fields during magnetic storms: Synthetic analysis of empirical United States impedances, Geophys. Res. Lett., 42(23), 10,160-10,170, doi:10.1002/2015GL066636.

Possible augmentation of MT survey (white)



Will provide data useful for induction-hazard science and
for fundamental geological understanding of the Earth's crust and lithosphere.

Installation of Geoelectric Monitoring at the USGS Boulder Observatory



USGS Mendenhall Post-Doctoral Fellowship

Earth electrical conductivity and magnetic-storm hazards

http://geology.usgs.gov/postdoc/

Opportunity 16-21

Carol A. Finn (cafinn@usgs.gov)

Jeffrey J. Love (jlove@usgs.gov)